

National Team System Engineering Overview



8 June 2004

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System Engineering &
Integration
Missile Defense Agency



MDA SYSTEM ENGINEERING CHALLENGE



Pre-Decisional / Working Papers

- **Near-Term Deployment - Initial Defensive Operations**
- **Engineering Challenge Dictates Use of Unified National Team**
 - **Open Consideration of All Solutions**
 - **Synergy of Distributed Sensors and Weapons**
 - **Element Alignment with BMDS Goals**
 - **Layered System**
 - **Network Centric Battle Management**



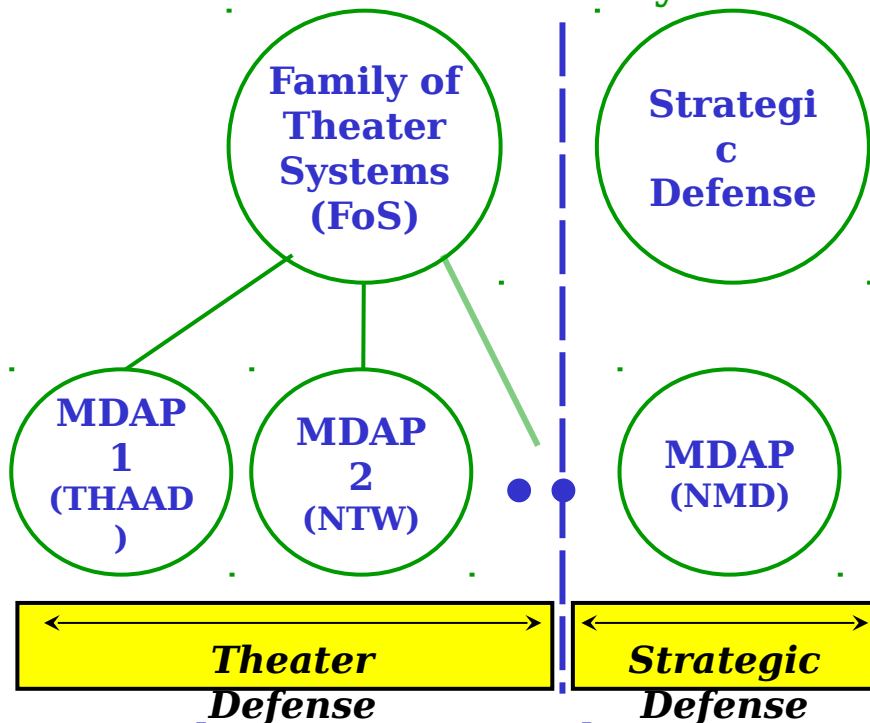
**Ballistic Missile Defense on Alert,
All Phases, All Ranges, All
Regions**



EVOLVED MISSILE DEFENSE PROGRAM

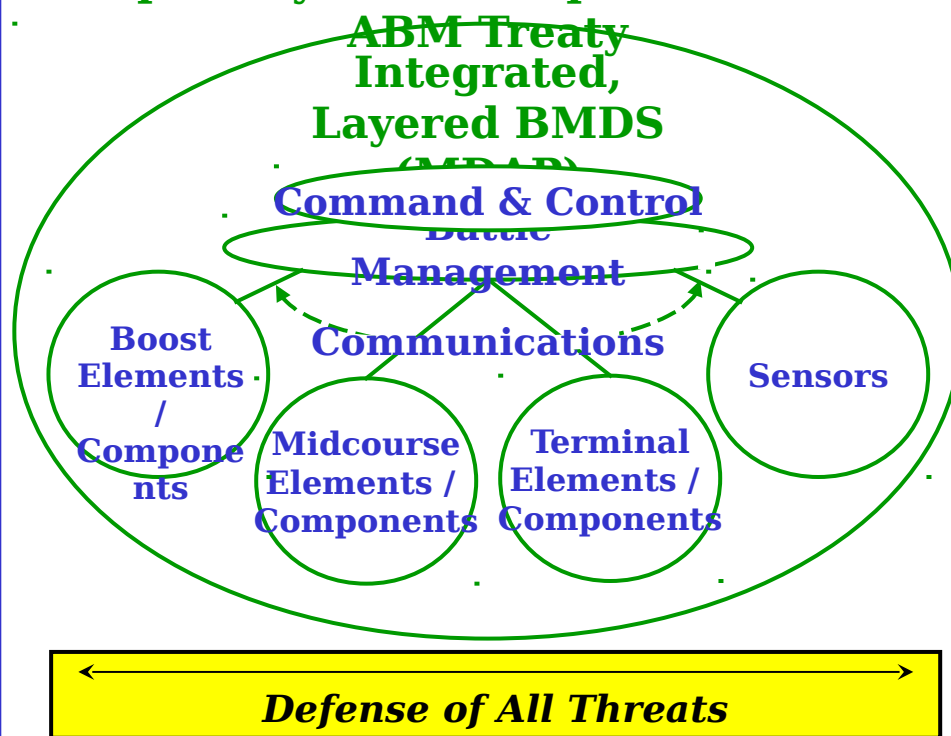
Pre-Decisional / Working Papers

Requirements-Based Acquisition Under ABM Treaty



- Each MDAP Optimized to Own ORD
 - FoS Secondary
- Aggregate FoS Performance
 - Synergistic, Limited Interoperability
- Each MDAP "Massive" Momentum, Culture,

Capability-Based Acquisition After ABM Treaty

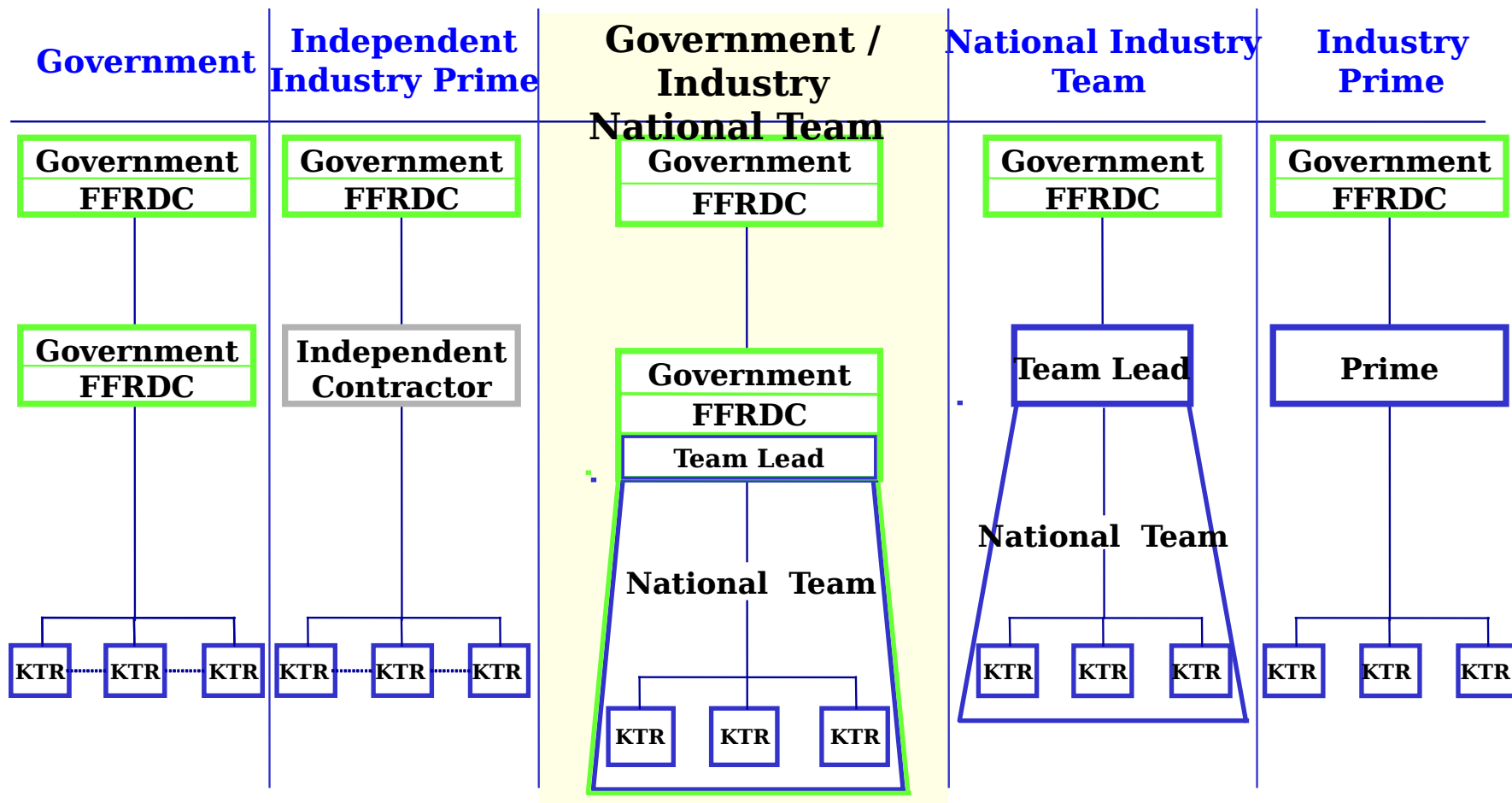


- Top-Down SE&I to "Component" Level
 - Optimize BMD System Performance
 - Disciplined, Quick, Flexible Change Management
- Annual Procurement and Fielding Decisions to Desired



NATIONAL TEAM MANAGEMENT MODEL OPTIONS

Pre-Decisional / Working Papers



BMDS Requires Unified Government / Industry National Team



ALIGNED MISSILE DEFENSE NATIONAL TEAM GUIDANCE



Pre-Decisional / Working Papers

- **National Team Focus - High Performance and Engineering Excellence**
- **National Team Commitment - Examine the Total Spectrum of Engineering Solutions**
- **Responsible and Accountable for Design and Integration of Defense System on Alert for Ballistic Missiles in *All Phases* of Flight that Grows to Protect *All Regions* from *All Ranges***
- **Government, SETA, FFRDC and Industry Committed to Provide “Best and Brightest” Team; Aligned into a Collaborative Work Environment; Organized by Functional Working Groups**
- **Leadership of Functional Working Groups Selected from Across National Team Based on Leadership and Knowledge**
- **MDNTS has Total System Performance Responsibility**

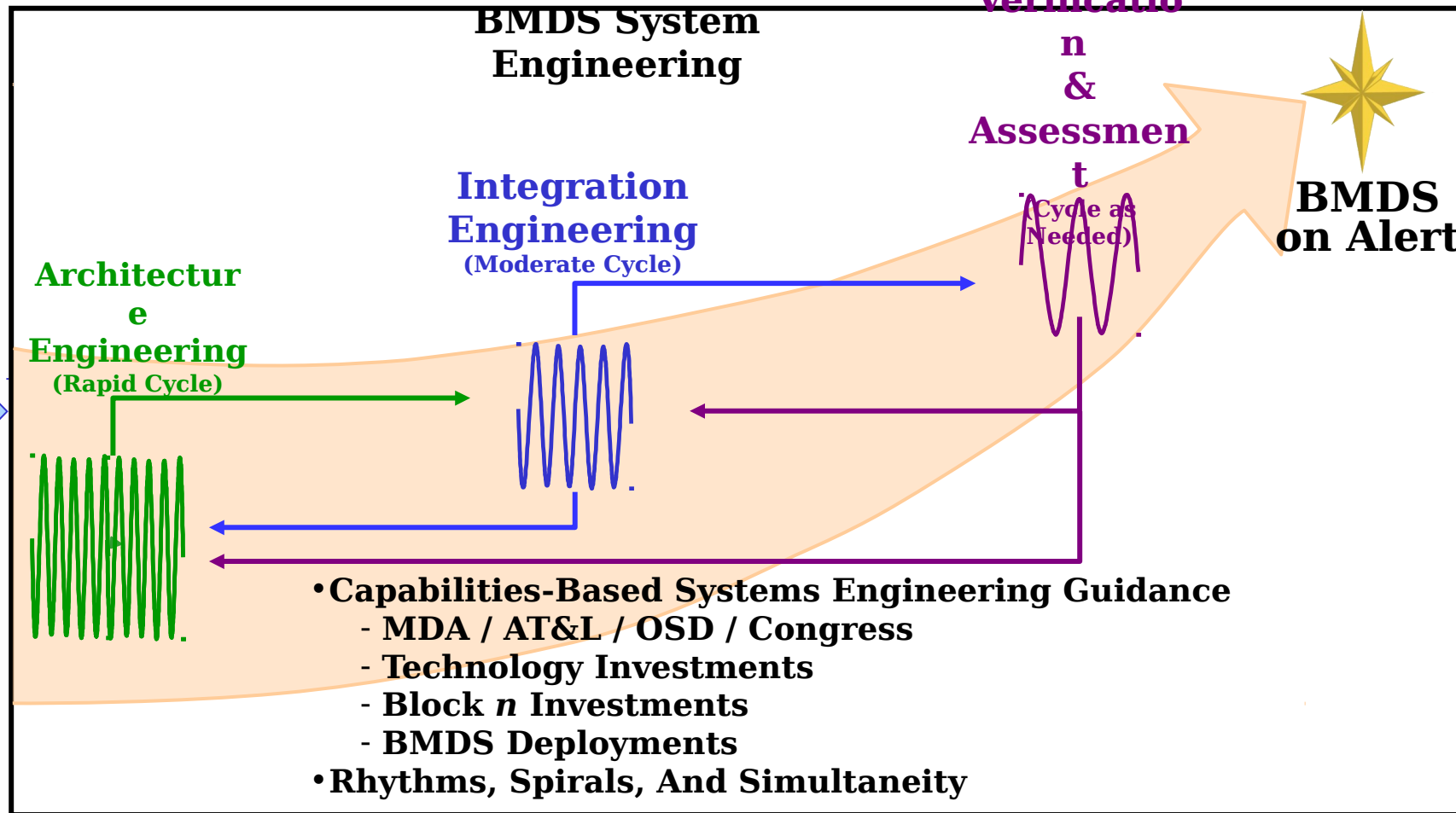


"MULTI-SPIRAL" BMDS SYSTEM ENGINEERING PROCESS

Pre-Decisional / Working Papers

Verification

Input / Guidance

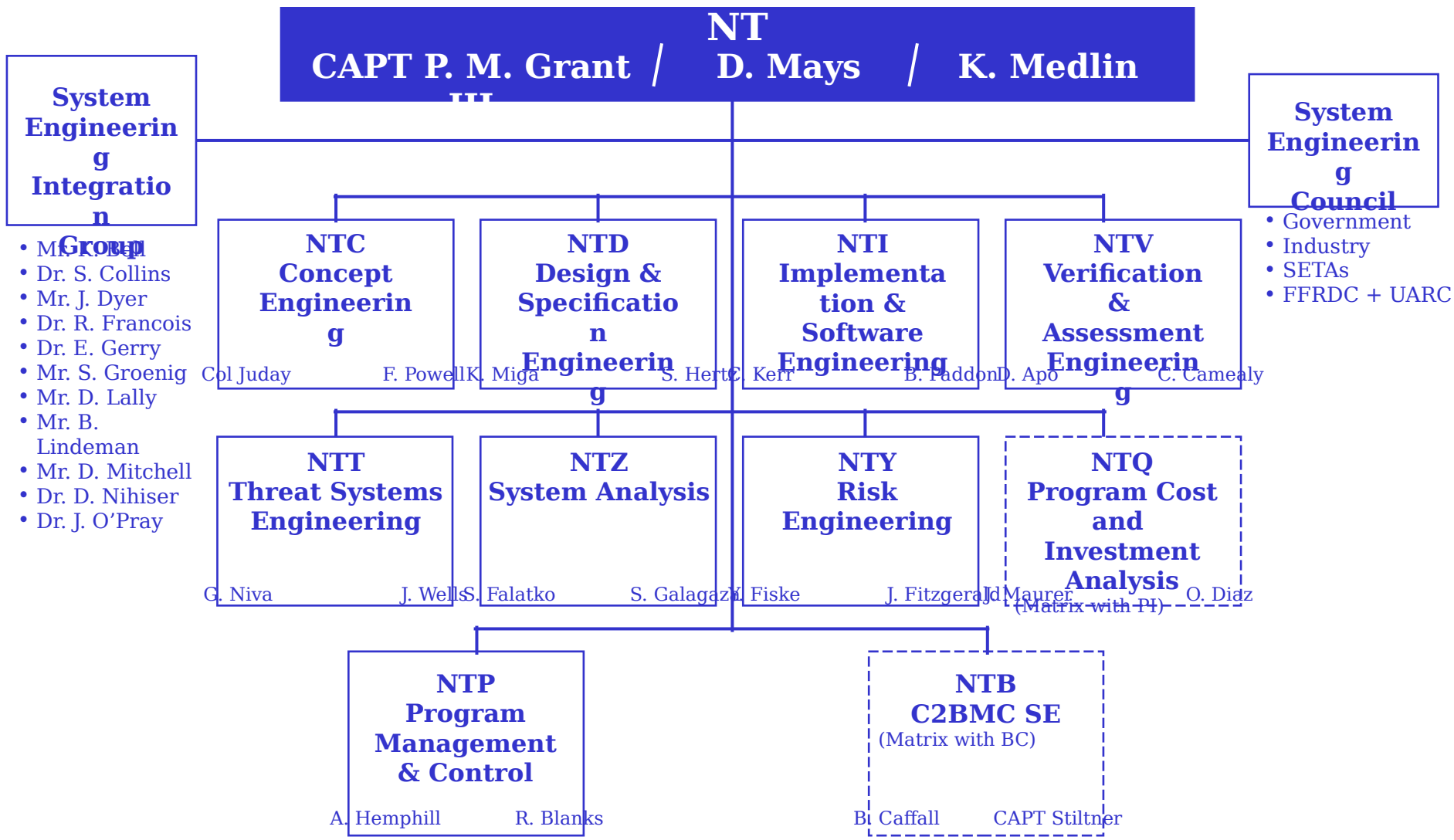


Engineering Management and Control



NATIONAL TEAM (NT) FUNCTIONAL GROUPS

Pre-Decisional / Working Papers





MDA SYSTEM ENGINEERING

Pre-Decisional / Working Papers

Concept Engineering (NTC)

- **Expand and Update the BMDS Technical Objectives and Goals (TOG) Based on Alternative Future Architecture Studies**
- **Develop System Evolution Plan**
- **Develop Block Data Packages Containing Threat Definition, System Architecture, Sub-System Descriptions, Possible Engagement Sequence Groups (ESGs), and Predicted System Performance**

Design Engineering (NTD)

- **Develop System Capability Specification (SCS)**
- **Develop Block Interface Control Specifications (ICS)**

Implementation and Software Engineering (NTI)

- **Provide Block System Integration Strategy, Plan, and Planning Allocation Matrix**
- **Configuration Control through Strict Adherence to Configuration Control Board Procedures**
- **Provide the Software Acquisition Program Plan (SWAP) and the Software Readiness Levels (SWRLs)**

Verification and Assessment Engineering (NTV)

- **Provide Block Capability Verification and Assessment Plan and Report, Test Objectives, and Target Requirements**

Enabling Engineering

- **Update Adversary Capability Document (ACD) (NTT)**
- **BMD System Risk Management (NTY)**
- **System Analysis for All System Engineering Functions (NTZ)**



BMDS CORNERSTONES

Pre-Decisional / Working Papers

- **Reaction Time**
 - First Detect to First Missile Movement
- **Raid Size Capacity**
 - Number of Threats Destroyed
- **Availability and Reliability**
 - Continuous Availability
- **Area Defended / Area Denied**
 - Defended Area
 - TBMD Launch Area Denied
- **Countermeasures & Environmental Resistance**

Battle Space is Driven by the Cornerstones

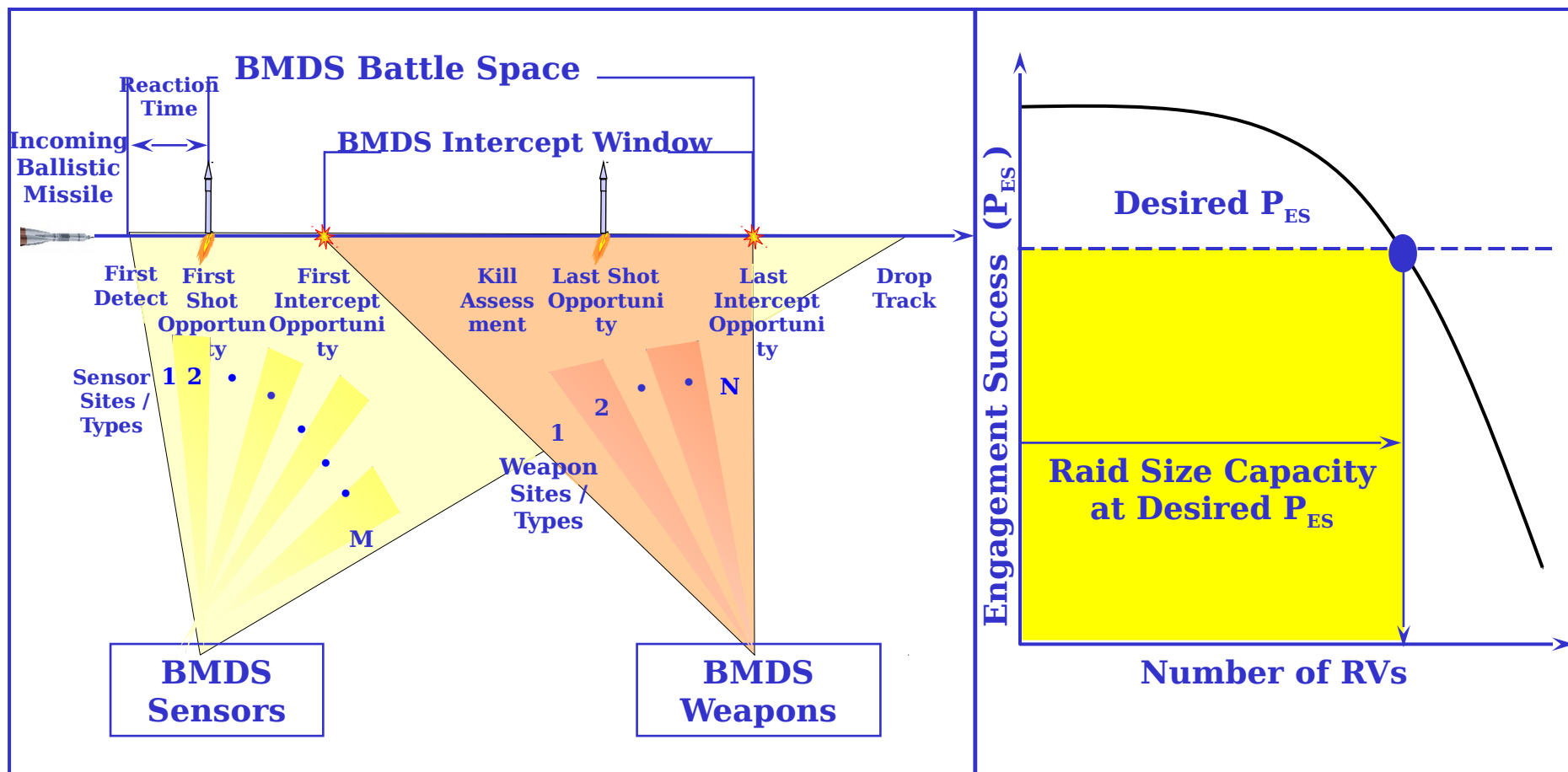


BMDS ENGAGEMENT CHARACTERIZATION



Pre-Decisional / Working Papers

BMDS Battle Space, Intercept Window, Reaction Time, and Raid Size Capacity

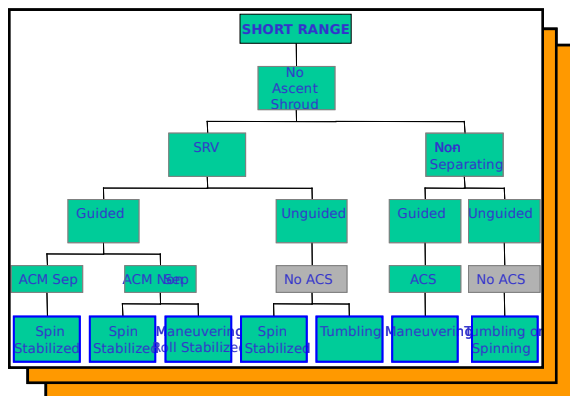




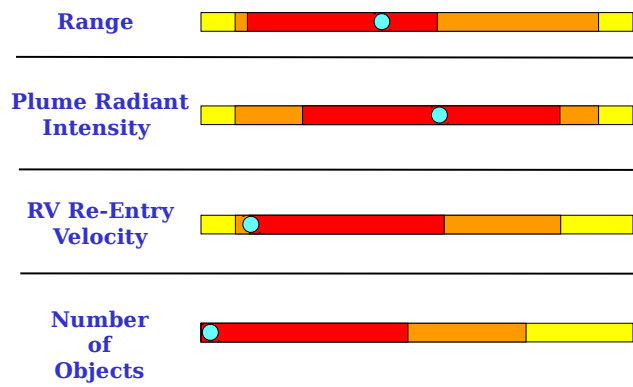
ADVERSARY CHARACTERIZATION

Pre-Decisional / Working Papers

Threat Missile Taxonomy

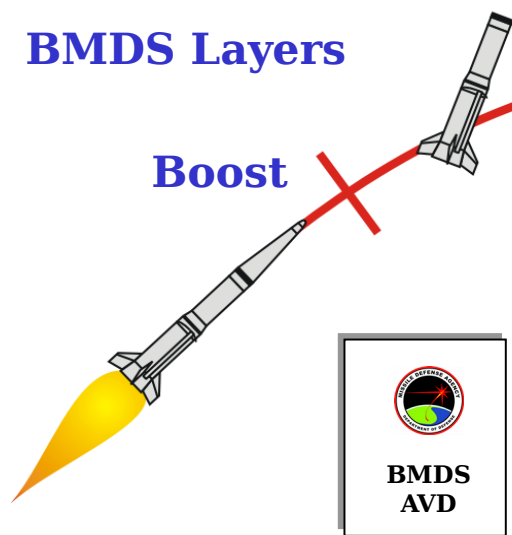


Parametric Adversary Capability

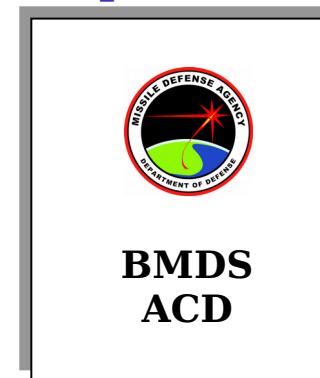


Midcourse

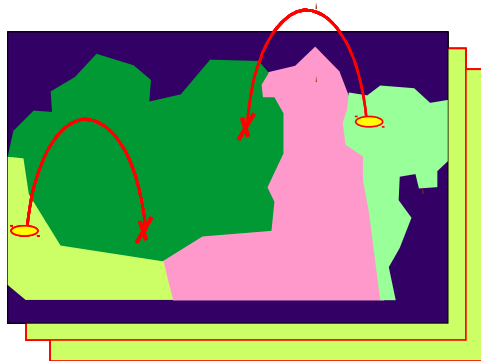
BMDS Layers



Adversary Capabilities



Adversary Vignettes



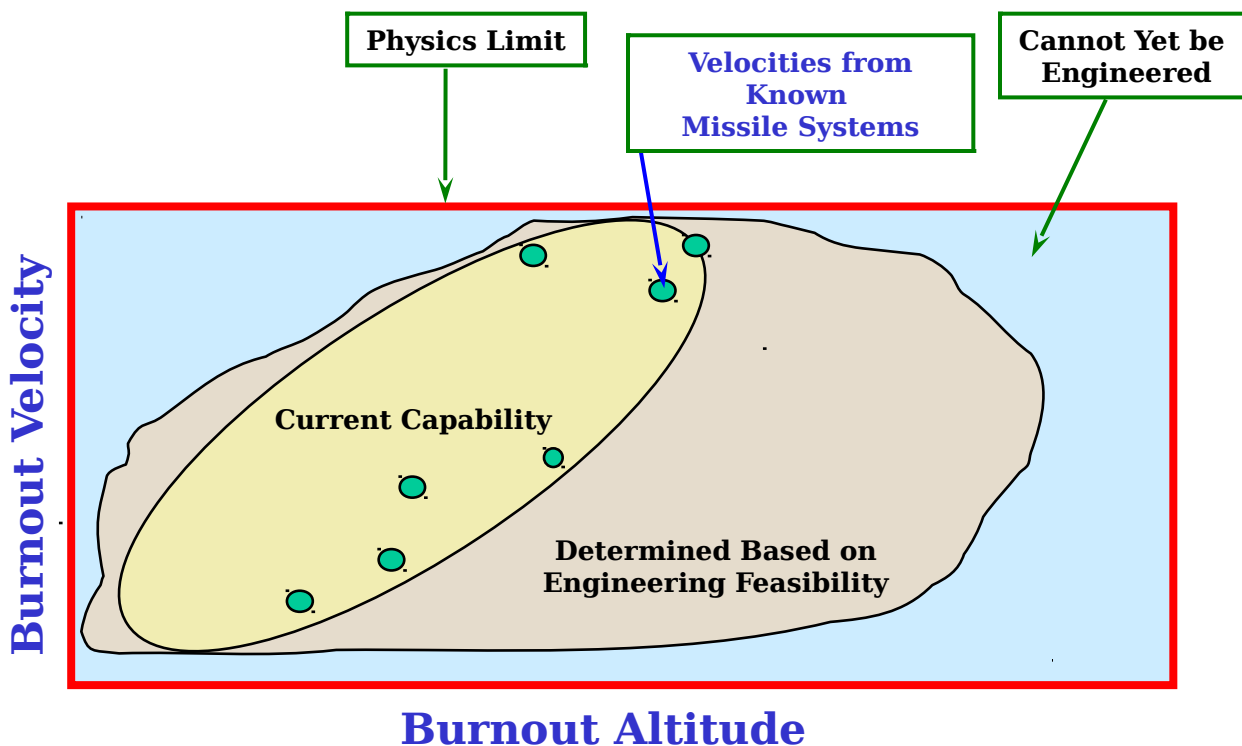


BOOST PHASE ADVERSARY CAPABILITY EXAMPLE



Pre-Decisional / Working Papers

Parameter - Physics-Based Burnout Velocity Space



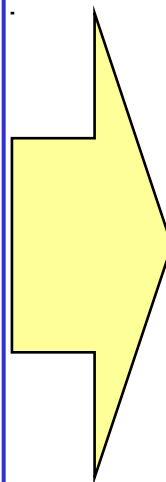


SYSTEM EVOLUTION PLAN (SEP)

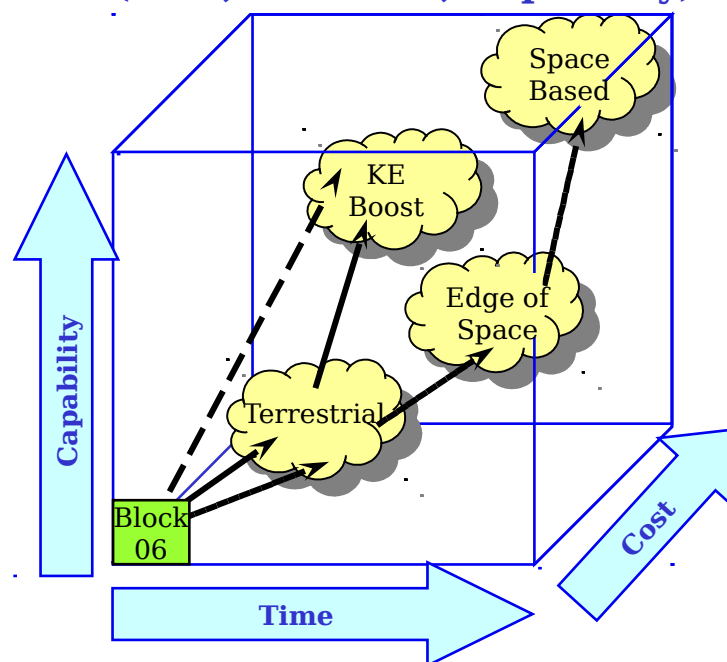


Pre-Decisional / Working Papers

- **SecDef Guidance, Director's Intent, and Guide Star Provide Initial and End State Vision for the BMDS**
 - Near Term - Defensive Presence in All Missions, All Phases of Flight
 - Far Term - Robust, Complementary Defenses for All Missions, All Ranges, All Engagement Phases Despite Countermeasures
- **The Long-Term Vision, Translated into Qualitative and Quantitative Terms, Drives the Top-Down BMDS Evolution Plan - the SEP**



Decision Space (Cost, Schedule, Capability)

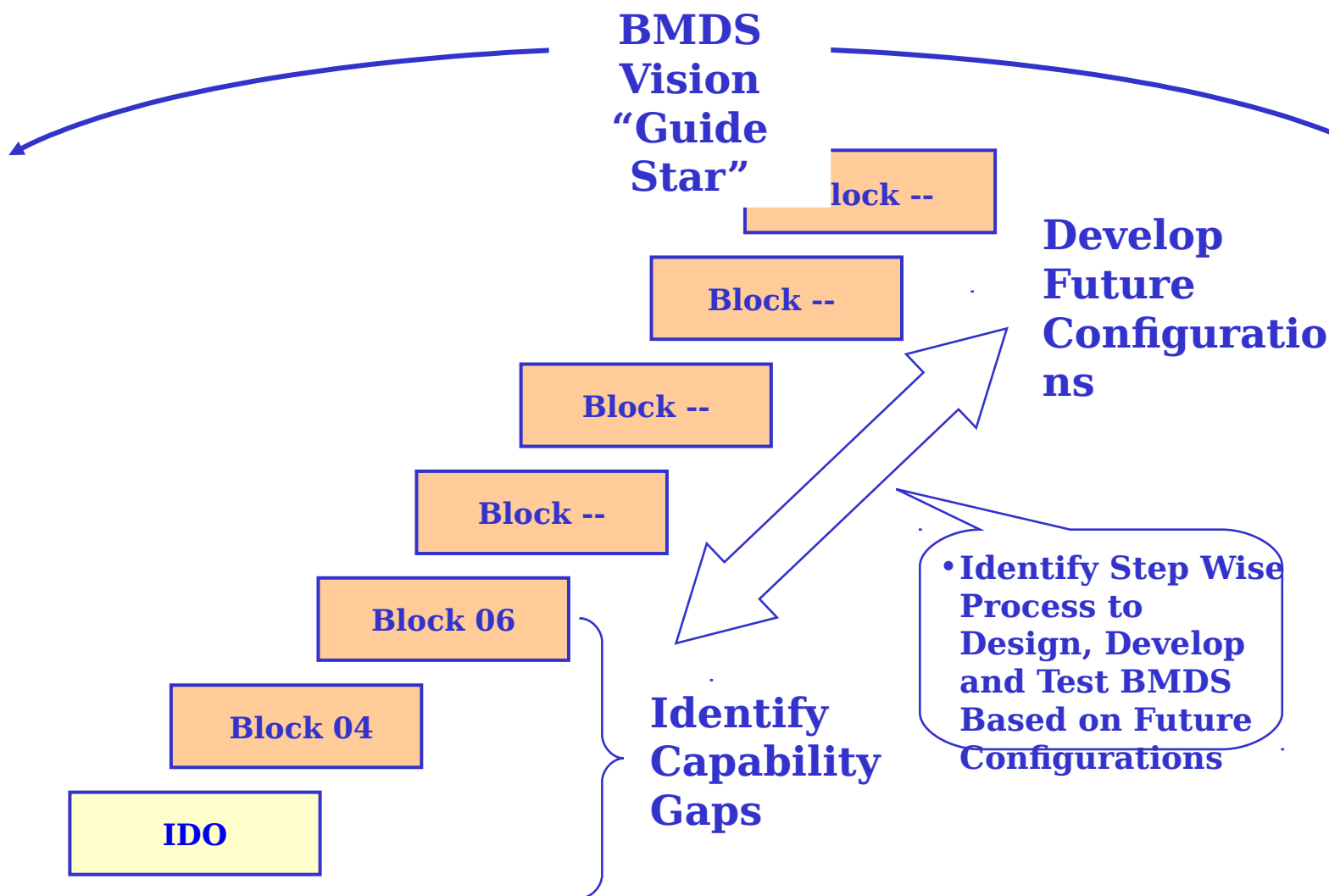


The SEP will Explore Alternative Paths / Strategies to Achieve TOG Compliance



BLOCK DEVELOPMENT PROCESS

Pre-Decisional / Working Papers

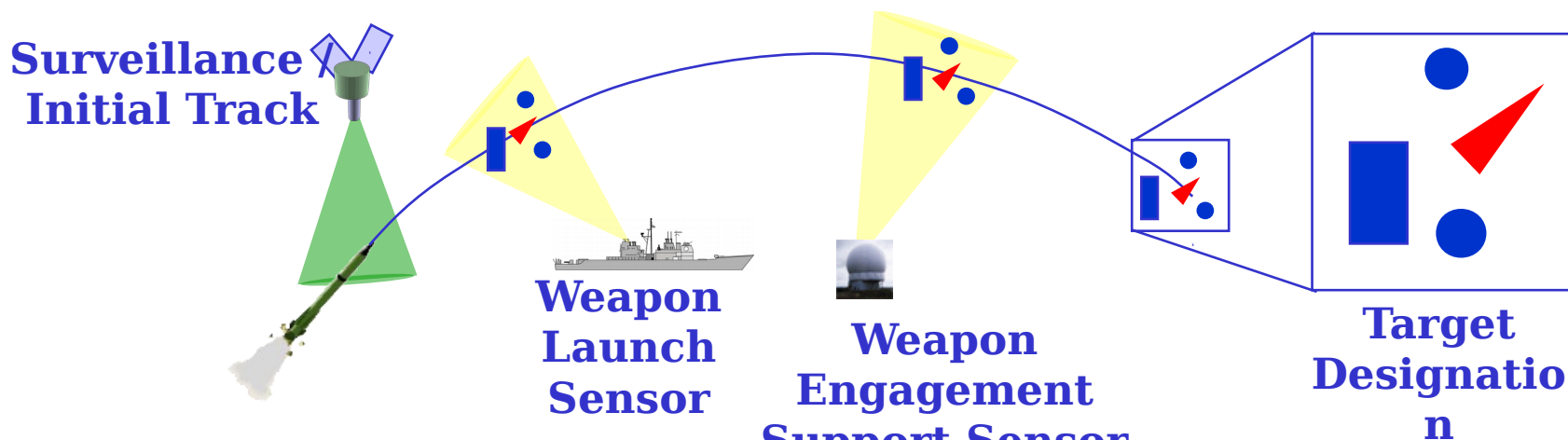




ENGAGEMENT SEQUENCE GROUPS

Pre-Decisional / Working Papers

- Engagement Sequences Occur when BMDS Components are Employed to Perform Detect-Control-Engage Functions
- All Engagement Sequence Groups Consist of
 - Sensor for Surveillance / Initial Detection and Tracking
 - Sensor for Weapon Launch
 - Sensor or Source for Engagement Support
 - Target Designation / Selection
 - Launcher / Missile or Directed Energy Weapon

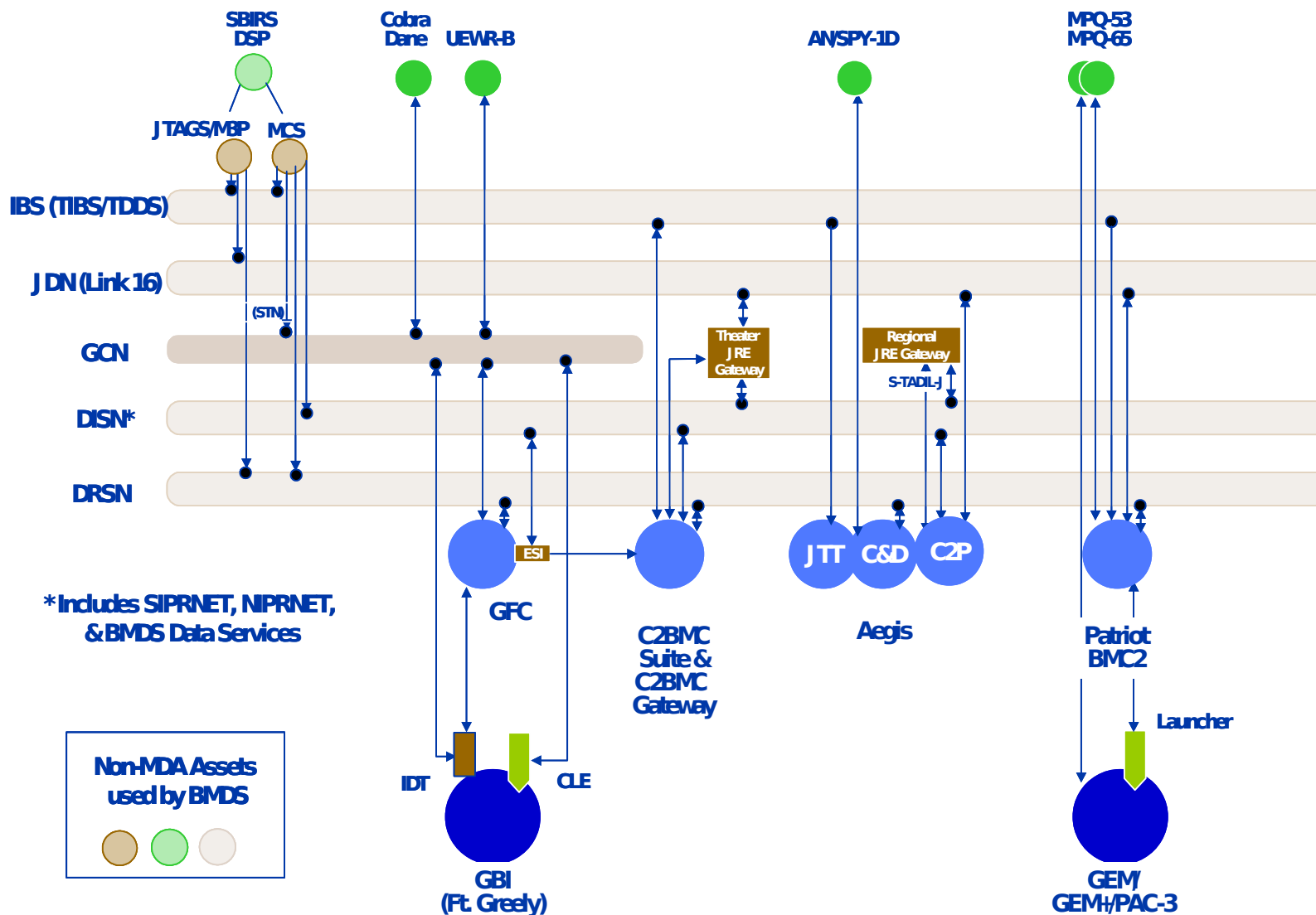


Engagement Sequences Enabled by Command and Control, Battle Management, and Fire Control Functions



IDC BMDS BLOCK DIAGRAM

Pre-Decisional / Working Papers





BMDS TECHNOLOGY INSERTION FUELS BLOCK EVOLUTION

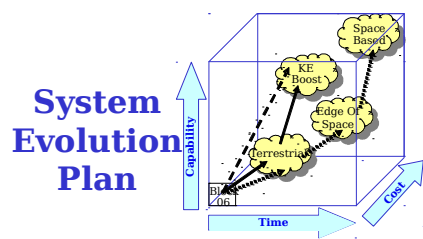
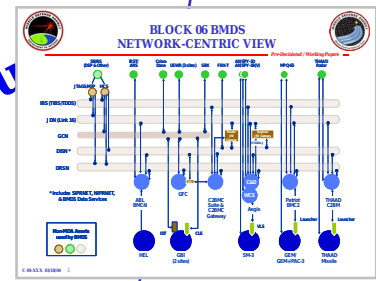
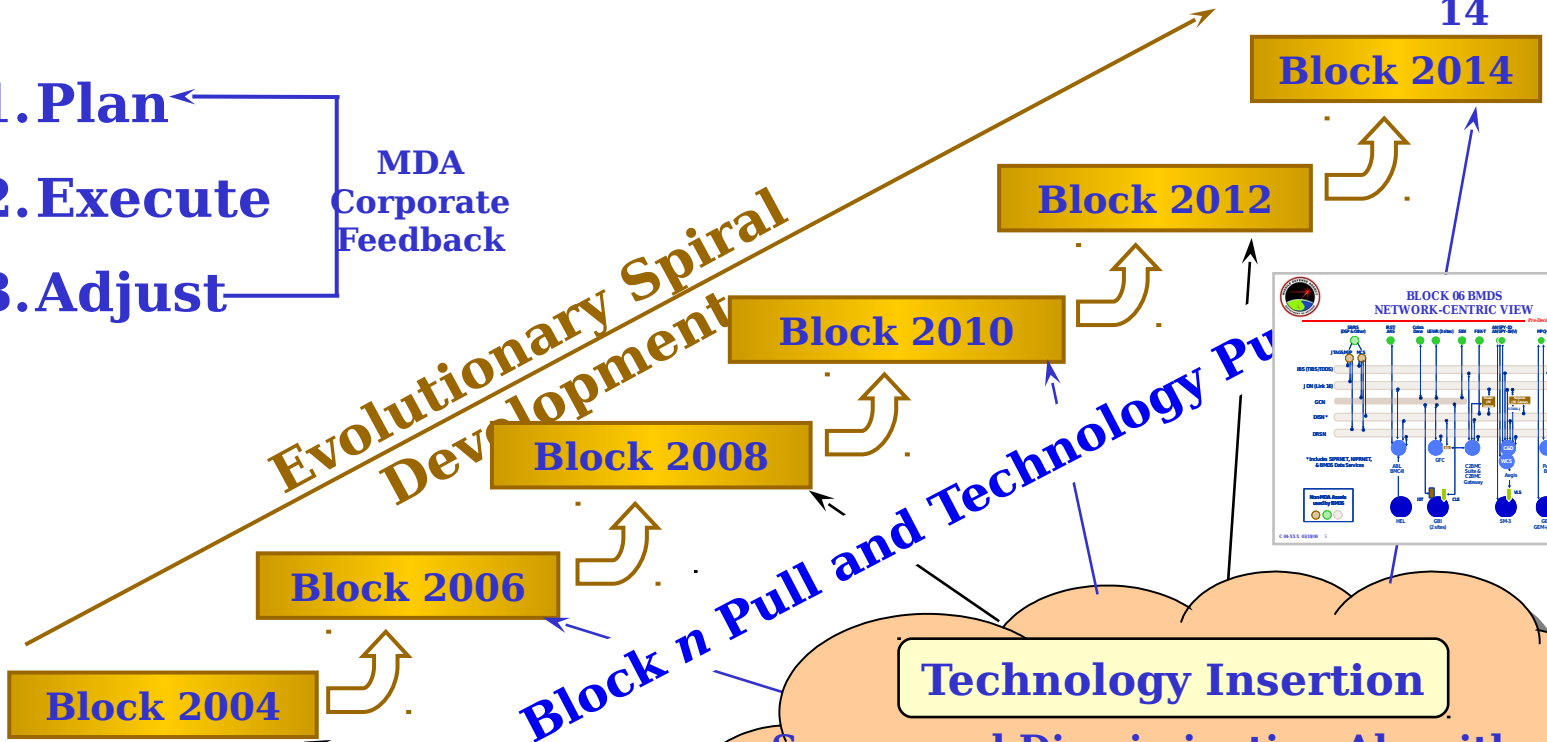
Pre-Decisional / Working Papers

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
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1. Plan
2. Execute
3. Adjust

MDA
Corporate
Feedback

**Evolutionary Spiral
Development**



Technology Insertion

- Sensor and Discrimination Algorithms
- Advanced Concept Technology Demonstrations
- Decision Architecture Upgrades
- "Next Generation" Radars
- Kill Vehicle and Seeker Improvements



SYSTEM ENGINEERING & INTEGRATION MISSILE DEFENSE NATIONAL TEAM

Pre-Decisional / Working Papers

Top Priorities

- **IDO BMDS on Alert**
 - BMDS Design
 - IDO Capability Verification
- **Define BMDS Blocks 08 /10**
 - Perform Concept Studies
 - PEER Review Process
 - Baseline Blocks
- **Design BMDS Block 06**
 - Achieve a Quantum Jump in BMDS Integration
 - Begin Evolution Away from Purely Autonomous Systems

**Performing a Function Not Possible with Any of the
Elements Acting Alone**



Pre-Decisional / Working Papers

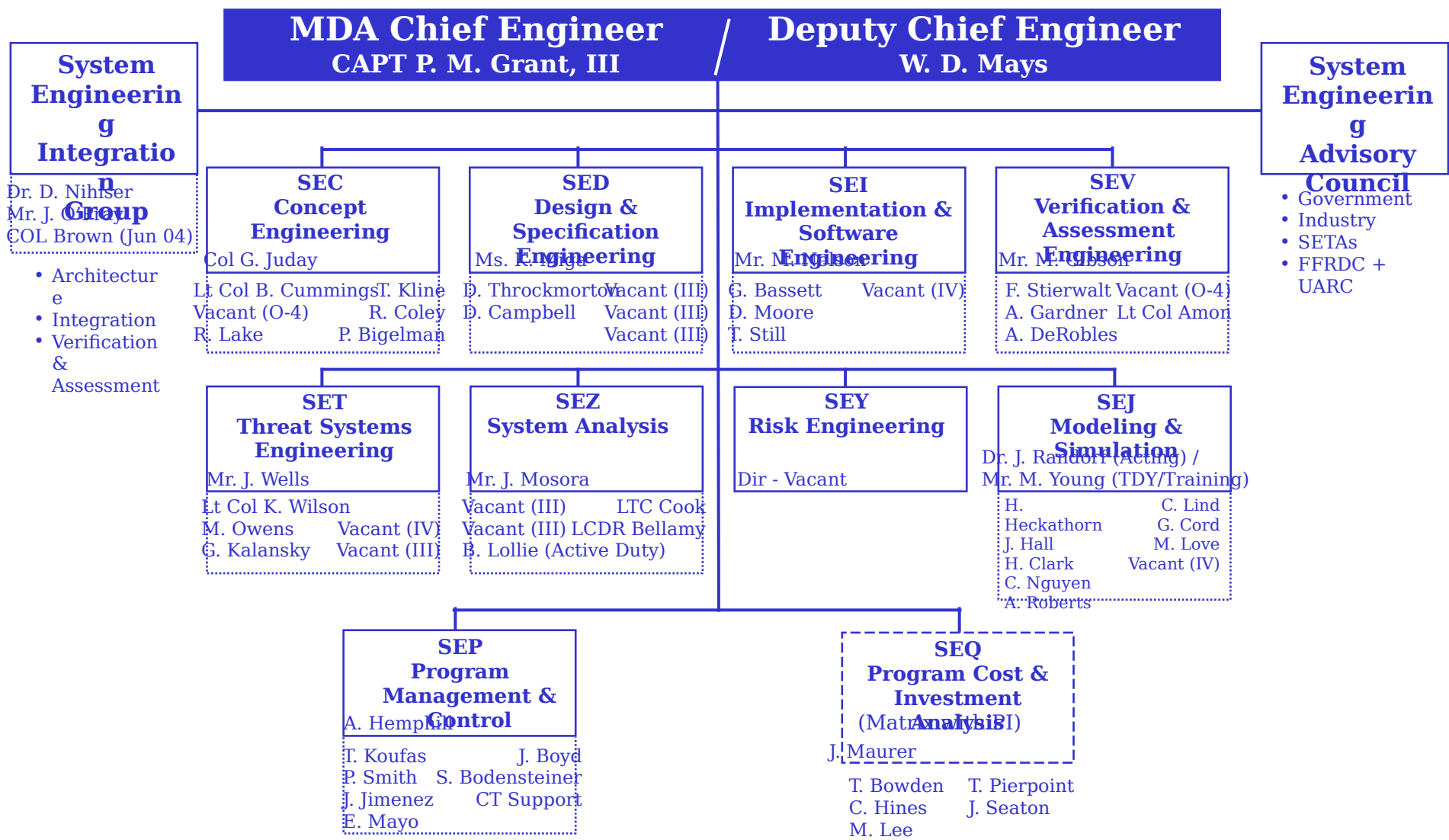
BACKUP



SE&I GOVERNMENT ORGANIZATION

- ACQ DEMO -

Pre-Decisional / Working Papers





MDNTS FUNCTIONAL WORKING GROUP CHARTER

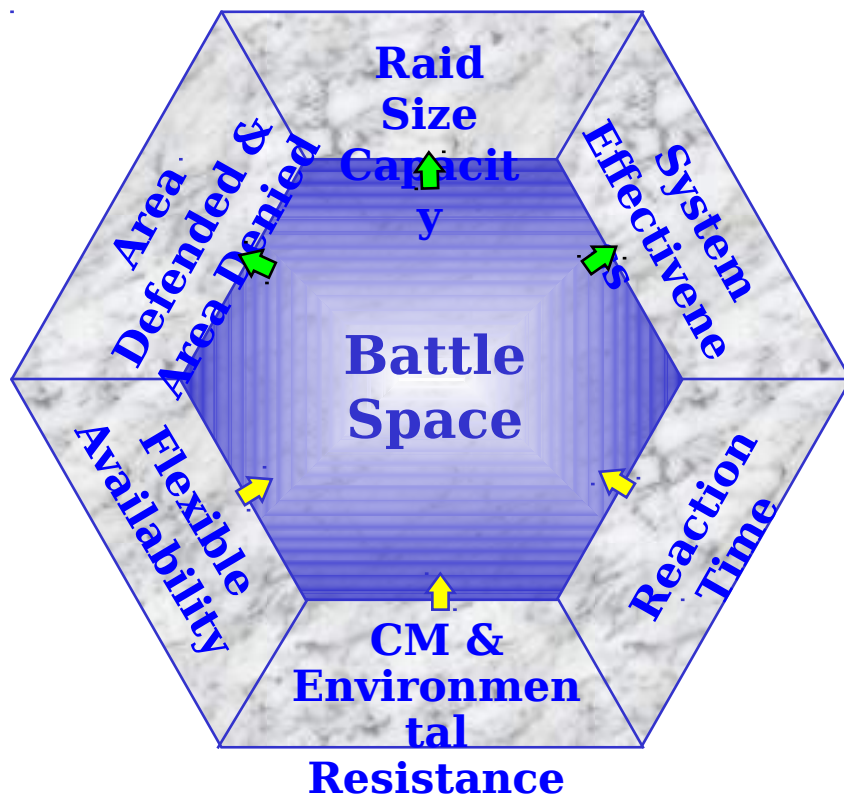
Pre-Decisional / Working Papers

NTC Concept Engineering • System Evolution Engineering and International Programs • TOG - Development & Maintenance • SEP - Development & Maintenance • Develops the Proposed Architecture / Block Structures • CM/CCM (Rainbow) - Blue Team • Technology Requirements	NTD Design & Specification Engineering • Performs the Detailed BMDS Engineering, Given an Architecture Construct • Performs Engineering Necessary to Establish and Document the BMDS Specifications • Standards • Specialty Engineering • Information Assurance Design	NTI Implementation & Software Engineering • Performs Detailed Engineering to Implement the Design • Software Engineering • Performs Configuration Management for BMDS • Performs Risk Mitigation Activities • Configuration Change Board (CCB) • Monitors TPMs	NTV Verification & Assessment Engineering • All Verification and Assessment Activities • Verification of Compliance with Mandated Processes • Assessment Activities Include the "As-Built" Assessments to Determine the Actual Capability • Verification Activities are Focused to Ensure the System Works as Specified • Define TPMs	NTT Threat Systems Engineering • ACD/AVD • Corporate Lethality Program • Threat - Threat Risk Assessments • Lethality - Interface with IN and the Special Programs Center • CM/CCM - Black Team
NTZ System Analysis • Conducts All of the Analysis to Support SE Efforts • Specific Sub-Groups will be Formed to Support Various SE Functions • A Single Analysis Team Ensures Consistency of Analysis	NTY Risk Engineering • Executes the Entire Risk Process Across the MDNTS Enterprise • Includes Identification, Assessment, Handling and Monitoring • Supports the Range of Risk Management from Supporting Gap Analysis of Architecture to Detailed Assessments of the Block Being	NTJ Modeling & Simulation Engineering • Development & Maintenance of the Core Models • Development & Maintenance of the "Virtual Model" • Includes Associated Facilities Such as ARC/SIM Center and Interface to JNIC System Level Simulations (e.g. HWIL)	NTO Program Cost and Investment Analysis • Develop Test Objectives • Develop Target Requirements • Command & Control Wargames • Perform Costing of the MDA BMDS • Perform Investment Analysis in the System Evolution Process	NTP Program Management & Control • Management Operations • Program Support to SE • Graphics • Business Management • Information Tech • Security • Facilities • Program Coordination



BMDS CORNERSTONES

Pre-Decisional / Working Papers



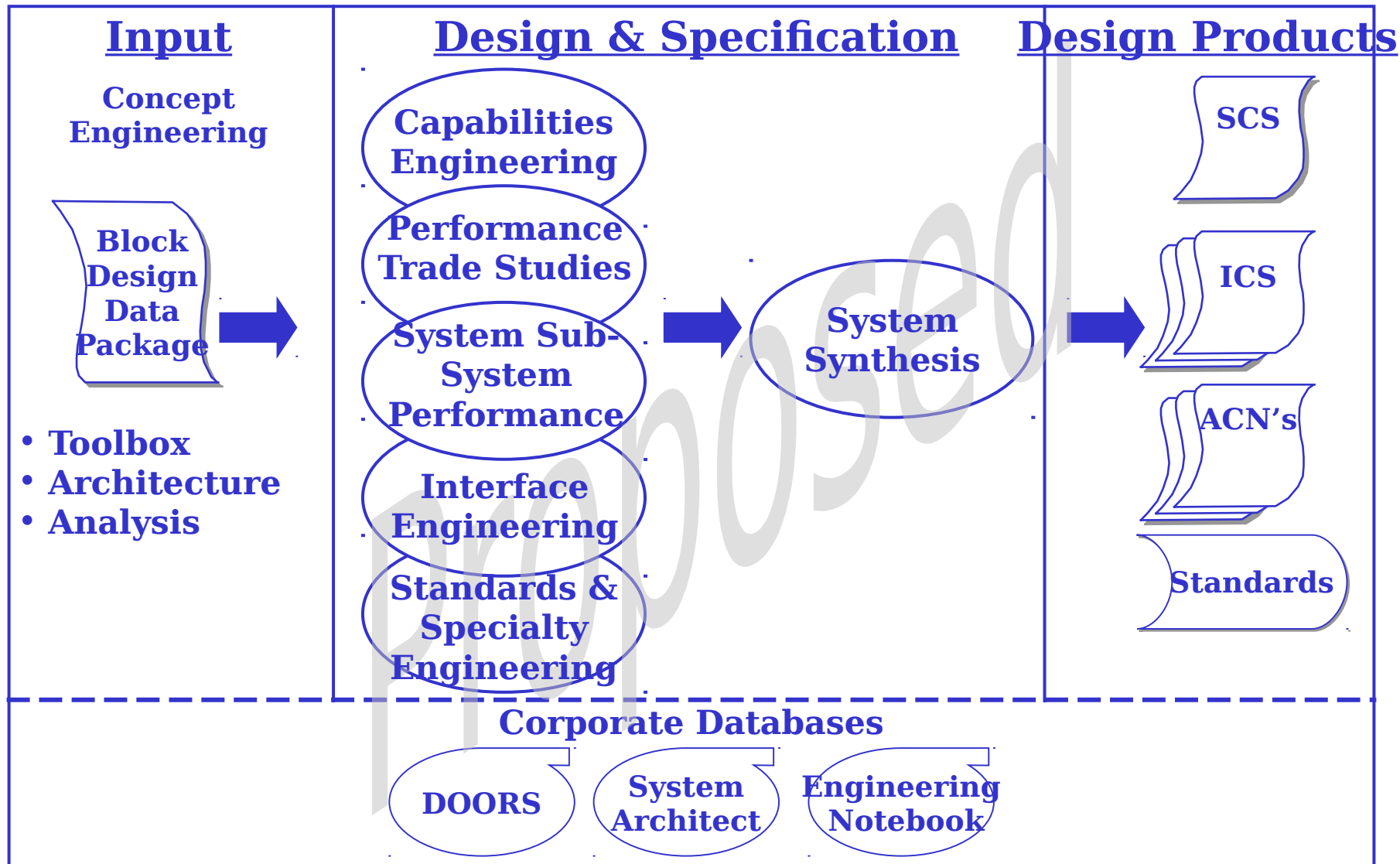
- **BMDS Cornerstones Satisfy Presidential Directive**
 - All Phases, All Ranges, All Regions
- **Cornerstones Define Technical Objectives and Goals Effectiveness Metrics**
- **Element Effectiveness Metrics Traceable to BMDS Cornerstones**
- **Cornerstones will Evolve**
 - Consequence of Capability-Based Acquisition

Cornerstones Describe Technical Objectives and Goals



DESIGN & SPECIFICATION ENGINEERING

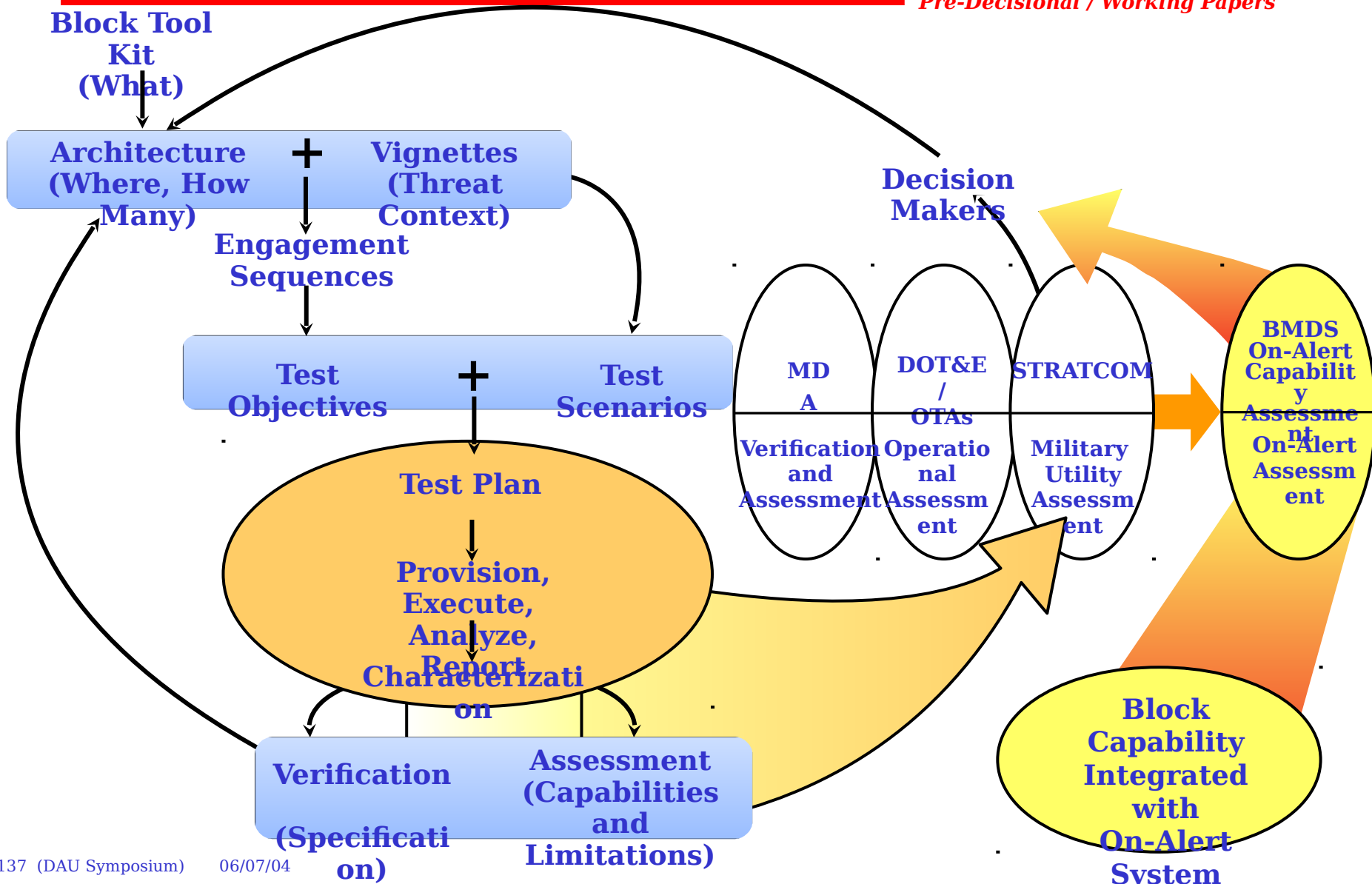
Pre-Decisional / Working Papers





BMDS TEST AND ASSESSMENT

Pre-Decisional / Working Papers



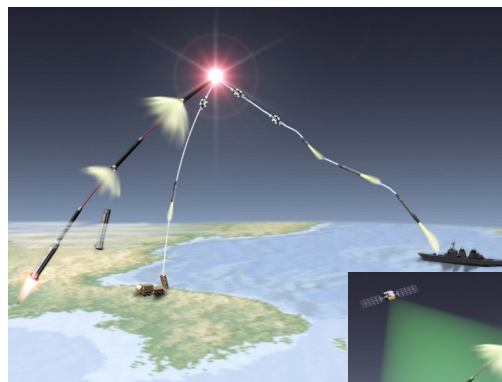


MDA DIRECTORATE COLLABORATION

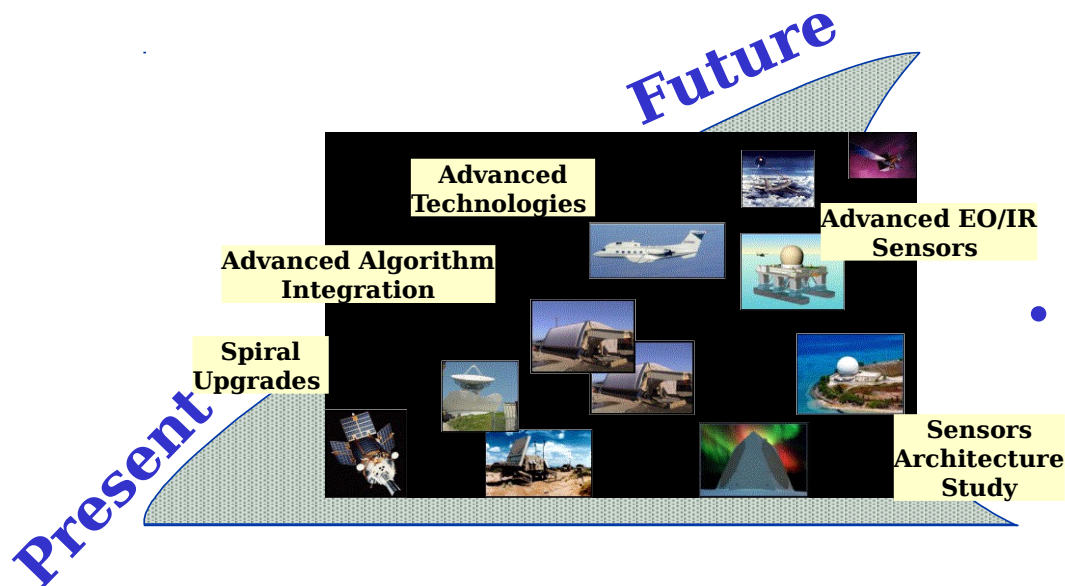


Pre-Decisional / Working Papers

- **Support to Kinetic
Interceptor
Directorate / Boost
Phase
Procurement**



**Overlay
Comparison**



- **Formation of BMDS
Netted Sensors
Directorate (MDA / SN)**



SYSTEM ENGINEERING CYCLE TIME REDUCTION

Pre-Decisional / Working Papers

Block 04 Definition & Design Cycle



Block 06 Definition & Design Cycle



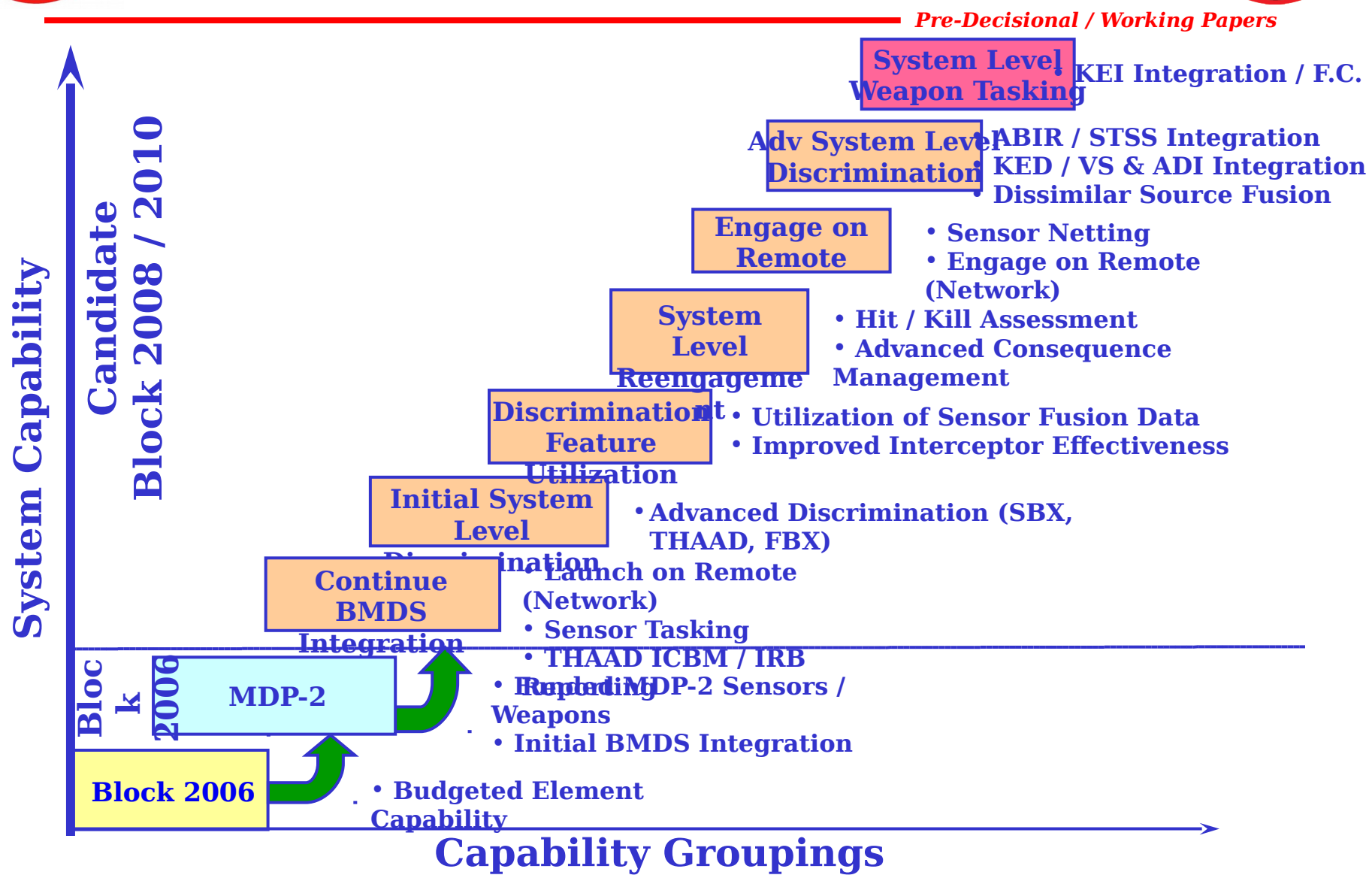
Block 08 Projected Definition & Design Cycle



Increasing System
Performance Through
Assessment of Multiple
System, Component
and Interface Options



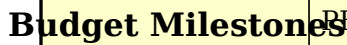
PRIORITIZED BLOCK CAPABILITY PROGRESSION





Pre-Decisional / Working Papers

MDNTS Schedule (Tier 1)



↓ Program Milestone

—◆ Slide



BMDS PERFORMANCE CORNERSTONES



Pre-Decisional / Working Papers

- **Reaction Time**
- **Launch Area Denied / Area Defended**
- **Flexible Availability**
- **Countermeasures and Environmental Resistance**
- **Raid Size Capacity**
- **BMDS Effectiveness**

